Navy Case No. 84912

TEST CHAMBER FOR A LOW BAND ANTENNA ARRAY

BACKGROUND OF THE INVENTION

1. Field of the Invention

The present invention relates generally to testing of antenna arrays. More specifically, the present invention relates to a miniature test chamber for the ALR-67 Radar Warning Receiver antenna array.

2. Description of the Prior Art.

The ALR-67 Radar Warning Receiver is an advanced Countermeasure Receiving Set that is the standard U.S. Navy radar warning receiver that is deployed on carrier based F/A-18 tactical aircraft. The ALR-67 Radar Warning Receiver, which includes a countermeasure computer is designed to enhance the survivability of pilots and their aircraft in a hostile environment. The ALR-67 Radar Warning Receiver also has a low band antenna array which is mounted on the aircraft fuselage in proximity to the cockpit.

There is currently a need to test the ALR-67 Low Band Antenna Array as an integral part of a total system for the ALR-67 Radar Warning Receiver. The testing needs to be performed over the frequency range of operation of the ALR-67 Low Band Antenna Array. Previous attempts to design a test chamber for the antenna array have not been acceptable in that the test chamber achieved acceptable operation over only a very small portion of ALR-67 Low Band Antenna Array's frequency range of operation.

There is a need to provide an anechoic chamber which is small in size and constructed so that electromagnetic interference does enter or exit the chamber. There is also a need to

provide a test signal to the ALR-67 Low Band Antenna Array at a specific azimuthal angle. The frequency response of the antenna array should be 30 dB +/- 10 dB over the frequency range of operation of the antenna array with no resonance peaks or dropouts.

SUMMARY OF THE INVENTION

The present invention comprises a Test Chamber for testing a frequency response of a Low Band Antenna Array output by injecting an RF test signal into the interior of the test chamber. The test chamber comprises a rectangular shaped steel enclosure having a lid. A microwave absorptive foam is affixed to the interior walls and base of the steel enclosure. The lid for the enclosure includes an opening and a pair of alignment pins for positioning the low band antenna array's monopole antennas within the interior of the test chamber. A probe is located in one corner of the test chamber to provide the RF test signal to the low band antenna array's monopole antennas.

The test chamber test the full frequency range of operation of the low band frequency antenna array. The microwave absorptive foam lining the interior walls of the steel enclosure and the base of the enclosure minimizes electromagnetic reflections within the interior of the test chamber. Minimizing the reflections of the injected signal produces no ambiguous input signals to the Low Band Antenna Array.

The test chamber also provides for isolation of internal RF signals by preventing the signals from radiating outside of test chamber 10 and isolates external RF signals from

entering test chamber 10 which causes interference.

BRIEF DESCRIPTION OF THE DRAWINGS

Fig 1(a) is a top view of the ALR-67 Low Band Antenna Array Test Chamber without a lid;

FIG. 1(b) is an end view of the test chamber of FIG. 1(a);

FIG. 1(c) is a top view of the lid for the test chamber of Fig. 1(a);

Fig. 1(d) depicts the probe utilized with the test chamber of Fig. 1(a); and

Fig. 2 is a RF insertion loss plot for the test chamber of Fig. 19(a) over the operating frequency of the ALR-67 Low Band Antenna Array.

DETAILED DESCRIPTION OF A PREFERRED EMBODIMENT

Referring to Figs. 1(a)-1(d), there is shown an ALR-67 low band antenna array test chamber, designated generally by the reference numeral 10 which is used to test the antenna array for the ALR-67 Radar Warning Receiver. The test chamber 10 comprises a rectangular shaped steel enclosure 12 with a removable lid 14. The steel enclosure has overall dimensions

of 10.00" (length) x 8.00" (width) x 4.00" (depth). The steel enclosure 12 used in the present invention is a Lift-Off cover "LP" box, Part No. A1008LP, which is commercially available from Hoffman Enclosures Inc. of Anoka, Minnesota. The dimensions shown in Figs. 1(a)-1(c) are in inches.

The interior 16 of enclosure 12 is filled with a microwave absorptive foam 18 as shown in Figs. 1(a) and 1(b). Microwave absorptive foam 18 is affixed to the interior of rear wall 20, front wall 22, and side walls 24 and 26 of enclosure 12 and the base 28 of enclosure 12. The thickness of microwave absorptive foam 18 is approximately 1.70 inches. The microwave absorptive foam used in the present invention is ECCOSORB AN Flexible Foam Sheet, Part No. AN-77 which is commercially available from Emerson and Cuming Microwave Products Inc. of Randolph, Massachusetts.

An SMA female connector 30 is mounted on front wall 22 of enclosure 12 at the midpoint of the front wall 22. A 0.141 inch diameter cable 32 connects the SMA female connector 30 to a probe 34. The positioning of the cable 32 and the probe 34 in the interior 16 of enclosure 12 as depicted in Fig. 1(a). is through the microwave absorptive foam 18 and then across the bottom of the interior 16 of enclosure 12 to probe 34. Probe 34 is positioned at corner 38 within the interior 16 of enclosure 12.

As is best illustrated in FIG. 1(d), probe 34 includes five helical turns of #22 solid copper wire 40 wound around the exterior of a one inch diameter schedule 40 PVC pipe 42. One end of solid copper wire 40 is connected to the center conductor of coaxial cable 32,

while the other end of wire 40 is connected to the outside conductor of coaxial cable 32. One added turn of the outside conductor 33 of the coaxial cable 32 is positioned around the exterior of the PVC pipe 42 as shown in FIG. 1(d). Probe 34 also has a 0.5 inch thick foam spacer 44 attached to the bottom end of pipe 42. The foam spacer 44 raises the probe 34 within the interior 16 of enclosure 12 such that top end of the probe rest against the bottom side of lid 14. The positioning of probe 34 within the interior 16 of enclosure 12 provides for maximum coupling between the low band antenna array being tested and the probe 34.

Referring to Fig. 1(d), the lid 14 for steel enclosure 12, has a centrally located six inch diameter opening 46 and a pair of alignment pins 48 and 50 positioned adjacent opening 46. The opening 46 and alignment pins 48 and 50 within lid 14 allow a user to position the ALR-67 Low Band Antenna Array on top of test chamber 10 with antenna array's monopole antennas precisely positioned within the interior 12 of test chamber 10.

Referring to Figs. 1(a) and 2, test chamber 10 was calibrated by the measuring the RF insertion loss of an injected signal to an omni element within the ALR-67 Low Band Antenna Array. Fig. 2 depicts the insertion loss, designated by the reference numeral 52, for the ALR-67 Low Band Antenna Array for a frequency response between frequency F1 and frequency F2. The insertion loss 52 shows no resonant spikes, only a smooth curve over the frequency range from frequency F1 to frequency F2. As shown in Fig. 2, the plot 52 meets a test requirement for an insertion loss of -30 dB plus or minus 10 dB over the operating frequency of the ALR-67 Low Band Antenna Array.

The microwave absorptive foam 18 lining the interior walls 20, 22, 24 and 26 of enclosure 12 and the base 28 of enclosure 12 minimizes electromagnetic reflections within the interior 16 of test chamber 12. Minimizing the reflections of the injected signal produces a distinctive angle of arrival with no ambiguous input signals from reflections at the ALR-67 Low Band Antenna Array.

The test chamber 10 provides for isolation of internal RF signals by preventing the signals from radiating outside of test chamber 10 and isolates external RF signals from entering test chamber 10 which causes interference. The combination of absorptive material 10 and a machined fit with the ALR-67 Low Band Antenna Array minimizes external and internal RF signal interference.

From the foregoing, it is readily apparent that the present invention comprises a new, useful, and exceedingly unique test chamber for testing an antenna array over its operating frequency which constitutes a considerable improvement over the known prior art. Many modifications and variations of the present invention are possible in light of the above teachings. It is to be understood that within the scope of the appended claims the invention may be practiced otherwise than as specifically described.